

2. (once amended) A method according to Claim 1 further comprising the step of determining a vector distance  $\vec{d}$  between two antennas mounted to the locomotive.

3. (once amended) A method according to Claim 2 further comprising the step of determining  $\vec{d}$  as  $\vec{d} = (\mathbf{H}^T \mathbf{H})^{-1} \mathbf{H}^T \vec{y}$ , where:

$$\mathbf{H} = \begin{bmatrix} \text{LOS}_x^1 & \text{LOS}_y^1 & \text{LOS}_z^1 \\ \text{LOS}_x^2 & \text{LOS}_y^2 & \text{LOS}_z^2 \\ \vdots & \vdots & \vdots \\ \text{LOS}_x^n & \text{LOS}_y^n & \text{LOS}_z^n \end{bmatrix};$$

$$\vec{y} = \begin{bmatrix} \Delta\phi^1 - \lambda(N_1^1 - N_2^1) - c(dt_1 - dt_2) \\ \Delta\phi^2 - \lambda(N_1^2 - N_2^2) - c(dt_1 - dt_2) \\ \vdots \\ \Delta\phi^n - \lambda(N_1^n - N_2^n) - c(dt_1 - dt_2) \end{bmatrix}; \text{ and}$$

$$\vec{d} = \begin{bmatrix} d_x \\ d_y \\ d_z \end{bmatrix}, \text{ where } \phi \text{ represents a fractional phase part.}$$

4. (once amended) A method according to Claim 30 wherein said step of determining at least one of an accurate heading, heading rate, attitude, and attitude rate of the locomotive further comprises the step of determining an attitude and an attitude rate of a locomotive using  $\vec{d}$ , the heading using  $\tan^{-1} \frac{d_x}{d_y}$ , and heading rate using  $\frac{\tan^{-1} d_z}{\sqrt{d_x^2 + d_y^2}}$ .

15. (once amended) An apparatus for determining at least one of motion and location parameters of a locomotive to detect curves and reduce track wear, said apparatus comprising:

at least two phase-locking satellite receivers configured to reference signals received from a set of satellites; and

a processor configured to determine a set of phase differences between the reference signals received by said satellite receivers and an accurate heading of the locomotive using the set of phase differences between the reference signals.

16. (once amended) An apparatus according to Claim 15 wherein said processor further configured to determine a vector distance  $\vec{d}$  between two antennas mounted to the locomotive.

17. (once amended) An apparatus according to Claim 16 wherein said processor further configured to determine  $\vec{d}$  as  $\vec{d} = (\mathbf{H}^T \mathbf{H})^{-1} \mathbf{H}^T \vec{y}$ , where:

$$\mathbf{H} = \begin{bmatrix} \text{LOS}_x^1 & \text{LOS}_y^1 & \text{LOS}_z^1 \\ \text{LOS}_x^2 & \text{LOS}_y^2 & \text{LOS}_z^2 \\ \vdots & \vdots & \vdots \\ \text{LOS}_x^n & \text{LOS}_y^n & \text{LOS}_z^n \end{bmatrix}$$

$$\vec{y} = \begin{bmatrix} \Delta\phi^1 - \lambda(N_1^1 - N_2^1) - c(dt_1 - dt_2) \\ \Delta\phi^2 - \lambda(N_1^2 - N_2^2) - c(dt_1 - dt_2) \\ \vdots \\ \Delta\phi^n - \lambda(N_1^n - N_2^n) - c(dt_1 - dt_2) \end{bmatrix}; \text{ and}$$

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$$\vec{d} = \begin{bmatrix} d_x \\ d_y \\ d_z \end{bmatrix}, \text{ where } \phi \text{ represents a fractional phase part.}$$

18. (once amended) An apparatus according to Claim 31 wherein said processor further configured to determine an attitude and an attitude rate of the locomotive using  $\vec{d}$ , the heading using  $\tan^{-1} \frac{d_x}{d_y}$ , and the heading rate using  $\frac{\tan^{-1} d_z}{\sqrt{d_x^2 + d_y^2}}$ .

PLEASE ADD THE FOLLOWING NEW CLAIMS

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30. A method in accordance with Claim 3, wherein said step of determining an accurate heading of the locomotive using the set of phase differences between the satellite reference signals further comprises determining at least one of an accurate heading rate, attitude, and attitude rate of the locomotive using the set of phase differences between the satellite reference signals.

31. An apparatus in accordance with Claim 17, wherein said processor further configured to determine at least one of an accurate heading rate, attitude, and attitude rate of the locomotive using the set of phase differences between the satellite reference signals.

**Remarks**

The Office Action mailed July 6, 2001 has been carefully reviewed and the foregoing amendment has been made in consequence thereof. Submitted herewith is a Submission of Marked Up Claims.